

Film Coating

Near-Frictionless Carbon

Background

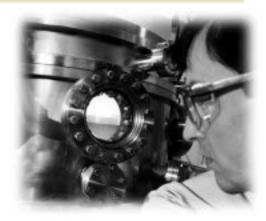
Coatings applied to engine components that slide, roll, or rotate reduce friction, increase engine durability, and improve performance. It is often difficult, time-consuming, or expensive to apply these coatings to all types and shapes of automotive parts – such as those made of plastic, ceramic, or certain metals. And the coatings may not be durable enough to hold up to the heat and friction encountered in today's engines.

Accomplishments

- Argonne National Laboratory has developed a near-frictionless carbon (NFC) film coating many times slicker than Teflon®. The new material's coefficient of friction is less than 0.001 when measured in a dry nitrogen atmosphere (Teflon's coefficient of friction is around 0.04).
- ◆ Thin (1-micrometer) NFC films can be deposited on virtually any substrate by ion-beam deposition, sputtering, or chemical vapor deposition at low temperatures (room temperature to 200°C) without risking damage to heat-sensitive materials.
- The most promising applications for the coating are automobile and engine parts – turbocharger rotors, piston rings, gears and bearings, air-conditioning compressors, and fuel injector components.
- ◆ In addition to being named an R&D 100 Award winner, the NFC coating was a finalist in the "Emerging Technology" category of the 1998 Discover Magazine Awards.

Benefits

- NFC has exceptional wear resistance and durability that reduce material and energy losses.
- The new process is quick it takes only a few hours – and is scalable to large batch production runs.
- ◆ The material adheres well to many kinds of substrates, including plastics.



- Near-perfect finished products have a smooth surface, uniform coverage, and good transparency; they do not require secondary machining or grinding.
- The ultrahard coating means longer lifetime and improved performance in rolling, sliding, and rotating components.
- Extremely slick coatings are ideal for sliding parts and machining of highprecision surfaces.
- ◆ The coatings offer higher productivity, lower costs, and improved environmental compliance (reduction or elimination of flammable and hazardous metalworking fluids).

Future Activites

- Develop processes for depositing NFC films on metal and ceramic components.
- Test the performance of the films over a wide range of loads, speeds, and temperatures to reduce friction and improve wear and corrosion properties.
- Optimize tooling and process conditions to coat large batches of components at low cost.

Partners in Success

Argonne National Laboratory Diesel Technology Company Front Edge Technology, Inc. Stirling Motors, Inc.

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